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PRODUCTION OF EXPLOSIVES IN THE UNITED STATES

DURING THE CALENDAR YEAR 1923

WITH NOTES ON MINE ACCIDENTS
DUE TO EXPLOSIVES

BY

WILLIAM W. ADAMS

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PRODUCTION AND DISTRIBUTION OF EXPLOSIVES IN THE UNITED STATES DURING THE CALENDAR YEAR 1923

By WILLIAM W. ADAMS

INTRODUCTION

The production of explosives in the United States during the calendar year 1923 was 23 per cent larger than in 1922, according to reports from manufacturers to the Bureau of Mines.[1] The manufacturers' reports showed that sales (excluding exports) during the year amounted to 8,078,053 kegs (201,951,325 pounds) of black blasting powder, 60,371,314 pounds of permissible explosives,[2] and 267,405,220 pounds of other high explosives, a total of 529,727,859 pounds in all. As compared with 1922, these figures represent an increase of 13 per cent for black powder, 39 per cent for permissibles, and 28 per cent for dynamite and other high explosives.

Coal mining was, as usual, the largest consumer of explosives; Of all black powder sold, coal-mining operations required 86.9 per cent, or 7,019,550 kegs; of all permissibles sold, coal mines used 94.1 per cent, or 56,806,709 pounds; of all other high explosives sold, coal mines consumed 14.2 per cent, or 37,828,979 pounds.

Metal mines and mines producing nonmetallic substances (excluding coal) used 2.2 per cent, or 174,929 kegs of all black powder; 1.3 per cent, or 783,475 pounds of the permissibles; and 39.3 per cent, or 105,003,900 pounds of all other high explosives.

Railway and other construction work used 370,442 kegs, or 4.6 per cent of the black powder; 324,225 pounds, or 0.5 per cent of the permissibles; and 31,930,021 pounds, or 11.9 per cent of the other high explosives.

Miscellaneous classes of work consumed 513,132 kegs, or 6.3 per cent of the black powder; 2,456,905 pounds, or 4.1 per cent of the permissibles; and 92,642,320 pounds, or 34.6 per cent of the other high explosives. Included in these figures are facts concerning large quantities of explosives used at stone quarries, but unfortunately, the data for quarries can not be segregated.

[1] In this publication "production" of explosives means the total sales during the year as reported by manufacturers.

[2] "Permissible explosives" are high explosives that, because of having passed certain tests prescribed by the Bureau of Mines, are considered reasonably safe for use in gaseous and dusty coal mines.

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CLASSIFICATION OF EXPLOSIVES

The figures tabulated herein are classified as follows:

1. *Black blasting powder*—All black powder with sodium or potassium nitrate as a constituent is here classified as black blasting powder.

2. *High explosives*—Dynamite and all other high explosives of various trade names and compositions, except permissible explosives, are put in this class.

3. *Permissible explosives*—In this class are included ammonium nitrate explosives, hydrated explosives, organic nitrate explosives, and certain nitroglycerin explosives containing an excess of free water or carbon. All permissible explosives have passed certain tests of the Bureau of Mines and are not te be regarded as permissible unless used in the manner specified by the bureau.[3]

ACKNOWLEDGMENTS

The compilation of this report is made possible by the hearty cooperation of explosives manufacturers and of Mr. C. Stewart Comeaux, sceretary of the Institute of Makers of Explosives. For this cooperation the Bureau of Mines expresses its deep appreciation. The author acknowledges the assistance rendered by Miss L. S. Gerry and Miss E. V. Walters in compiling the statistical tables herein presented.

SCOPE OF STATISTICS

The data for 1923 presented in this publication represent sales of explosives by 24 companies. Of these companies, 15 sold black blasting powder, 12 sold permissible explosives, and 14 sold high explosives other than permissibles. Some of the manufacturers operated more than one plant, so that the number of companies does not indicate the number of operating plants.

Reports of manufacturers of ammunition and fireworks are not included in this publication, because the majority of such companies purchase their explosives from the manufacturers whose production has been included in the tables herein presented. Nor does this publication include the production of nitroglycerin, except in so far as nitroglycerin is used in the manufacture of other explosives.

PRODUCTION AND DISTRIBUTION OF EXPLOSIVES

The quantity of each of the three main classes of explosives used in each State during the calendar years 1922 and 1923 is shown in Table 1.

[3] Hall, Clarence, Snelling, W. O., and Howell, S. P., Investigation of explosives used in coal mines, with chapter on the natural gas used at Pittsburgh, by G. A. Burrell, and an introduction by C. E. Munroe: Bull. 15, Bureau of Mines, 1912, 197 pp.; Hall, Clarence, and Howell, S. P., Tests of permissible explosives: Bull. 66, Bureau of Mines, 1913, 313 pp.

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TABLE 1. *Amount of explosives (excluding exports) manufactured in the United States and used in the various States during the calendar years 1922 and 1923*

State	1922			1923		
	Black blasting powder	High explosives other than permissible	Permissible explosives	Black blasting powder	High explosives other than permissible	Permissible explosives
	Kegs	*Pounds*	*Pounds*	*Kegs*	*Pounds*	*Pounds*
Alabama	189,524	6,007,360	4,292,969	173,969	7,761,661	5,290,975
Alaska	2,790	1,970,030	48,100	113	2,761,455	95,350
Arizona	50,527	7,772,071	43,700	34,287	11,412,792	30,500
Arkansas	51,989	1,431,761	47,300	66,408	1,522,669	114,300
California	134,362	16,877,066	24,550	195,044	18,642,521	19,700
Colorado	87,444	3,554,877	821,274	79,893	4,173,350	866,150
Connecticut	597	655,515		592	704,375	50
Delaware	120	43,589		161	59,607	450
Florida	2,813	3,289,875	4,500	4,302	4,022,775	2,750
Georgia	12,770	913,477		14,688	1,211,221	37,344
Idaho	14,137	3,467,835		19,896	4,335,925	15,450
Illinois	1,160,865	6,421,785	2,758,300	1,487,193	6,943,880	3,854,628
Indiana	804,118	2,423,426	496,825	853,764	3,372,533	921,525
Iowa	238,779	2,105,449	19,650	305,995	2,495,649	50,050
Kansas	238,417	5,739,178	70,450	315,830	7,048,336	104,700
Kentucky	836,102	2,050,861	1,781,450	687,207	3,779,450	1,900,740
Louisiana	404	1,013,805	204,800	408	1,304,420	203,250
Maine	1,734	634,177		1,742	690,922	
Maryland and D. C.	24,095[2]	1,385,787	221,700	31,181	1,701,175	188,455
Massachusetts	3,291	804,889	500	1,442	843,570	1,000
Michigan	9,101	15,601,558	44,550	11,213	18,034,875	46,250
Minnesota	78,404	9,146,013	1,350	59,951	14,657,683	
Mississippi	1,486	790,375	18,950	2,240	862,113	13,300
Missouri	143,573	7,467,089	79,350	134,647	8,640,809	77,675
Montana	95,797	4,755,122	33,400	116,339	6,414,452	84,450
Nebraska	3,180	179,789		1,766	259,510	100
Nevada	14,610	2,655,445		44,946	3,443,540	7,500
New Hampshire	332	136,050		702	160,575	1,650
New Jersey	1,660	1,813,305		1,205	2,437,273	500
New Mexico	7,572	1,136,980	472,200	12,856	2,549,595	430,850
New York	13,703	10,684,021	203,500	11,741	10,674,422	201,600
North Carolina	30,288	2,703,955	7,900	32,279	3,194,456	27,600
North Dakota	40,448	397,500	40,500	45,018	291,425	29,075
Ohio	485,471	7,248,511	81,369	546,193	8,928,349	135,500
Oklahoma	114,378	9,627,558	447,598	83,405	12,082,919	323,605
Oregon	39,901	4,853,230	7,050	38,967	5,331,853	152,750
Pennsylvania	1,169,690	31,509,040	18,669,539	1,565,103	46,450,311	30,278,425
Rhode Island	214	124,350		298	337,700	
South Carolina	1,682	487,925		2,506	546,025	
South Dakota	3,158	1,419,425		1,155	1,276,235	500
Tennessee	143,256	2,562,340	448,575	147,838	2,940,045	638,250
Texas	56,697	2,283,517	173,600	47,843	2,458,795	131,300
Utah	19,695	3,270,710	1,639,500	23,205	6,500,812	1,029,600
Vermont	3,761	712,921		4,620	878,603	250
Virginia	112,257	3,010,958	692,350	108,366	3,715,825	983,700
Washington	58,100	7,587,874	582,925	50,462	8,871,855	751,920
West Virginia	553,570	3,645,083	8,552,719	592,682	5,331,775	10,786,135
Wisconsin	2,413	4,443,202	102,275	2,645	4,322,995	2,000
Wyoming	95,374	659,425	294,500	113,747	1,022,109	539,462
Total	{[1] 7,154,649 [2] 178,866,225}	209,476,084	43,429,768	{[1] 8,078,053 [2] 201,951,325}	267,405,220	60,371,314
Grand total (pounds)		431,772,077			529,727,859	
Quantity used for coal mining	6,190,478	25,497,758	40,197,939	7,019,550	37,828,979	56,806,709
Quantity used for other mining	167,700	78,074,489	1,452,500	174,929	105,003,900	783,475
Quantity used for railway and other construction work	309,819	22,434,206	154,112	370,442	31,930,021	324,225
Quantity used for all other purposes	486,652	83,469,631	1,625,217	513,132	92,642,320	2,456,905
Total	7,154,649	209,476,084	43,429,768	8,078,053	267,405,220	60,371,314

[1] Kegs of 25 pounds. [2] Pounds.

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BLACK BLASTING POWDER

During the year covered by this report 8,078,053 kegs of black blasting powder were sold for use in the United States. This amount represents an increase of 13 per cent over 1922 and 26 per cent over 1921, but it is lower than for 7 of the 11 years preceding 1923 for which statistics are available. Coal mines are the chief users of black powder, but mining companies are gradually abandoning the use of black powder and substituting permissible explosives. Table 5 shows the extent to which permissibles have replaced black powder in coal mines since 1917. Of the total amount of blasting powder sold in 1923 (Table 13), coal mines used 86.9 per cent, other mines 2.2 per cent, railway and other construction work 4.6 per cent, and miscellaneous work 6.3 per cent. The amount used for coal mining was 7,019,550 kegs, an increase of 13 per cent over the amount similarly used in 1922.

HIGH EXPLOSIVES

Sales of high explosives other than permissibles reached a new high mark in 1923, the quantity sold (267,405,220 pounds) exceeding by 2 per cent the amount sold in 1917, which until 1923 was the record year. The 1923 sales were 28 per cent in excess of those for 1922. Metal mines are the largest single consumer of dynamite and other high explosives (excluding permissibles); in 1923 they used 39.3 per cent of the total quantity sold for all purposes in the United States. Coal-mining operations consumed 14.2 per cent, of which the larger part was used in the anthracite mines in Pennsylvania; railway and other construction work used 11.9 per cent; and miscellaneous classes of work used 34.6 per cent. The amount of high explosives used at metal mines was 105,003,900 pounds—an increase of 34 per cent over 1922, and exceeding all previous years except the three war years 1915, 1916, and 1917.

PERMISSIBLE EXPLOSIVES

The quantity of permissible explosives used in the United States in 1923 was larger than in any other year for which statistics are available. Sales reported by manufacturers totaled 60,371,314 pounds, an increase of 39 per cent over 1922 and 12 per cent over 1920, the previous banner year. Of the total sales, 94.1 per cent was for coal mines, 1.3 per cent for other mines, 0.5 per cent for railway and other construction work, and 4.1 per cent for other kinds of work. Coal mines not only used more permissibles than ever before, but the increase of permissibles was greater than the increase in the production of coal. In other words, the consumption of permissibles per thousand tons of coal was larger than in any previous year, as indicated in Table 5.

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TABLE 2. *Amount of black blasting powder used in the United States during 1922 and 1923, classified by use*

[Kegs of 25 pounds each]

Groups of States	Black blasting powder							
	1922				1923			
	Coal mining	Other mining	Railway and other construction work	All other purposes	Coal mining	Other Mining	Railway and other construction work	All other purposes
	Kegs	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont		12	63	9, 257		10	262	8, 532
Group 2. Connecticut, New Jersey, and New York	121, 799	3, 157	1, 581	11, 222	123, 635	1, 400	622	11, 516
Group 3. Delaware, District of Columbia, Maryland, and Virginia	1, 079, 042	3, 955	8, 606	6, 067	1, 455, 726	1, 245	6, 756	8, 071
Pennsylvania	523, 203	1, 450	1, 853	84, 840	552, 051	1, 529	3, 568	104, 280
West Virginia	2, 779	2, 491	18, 962	9, 955	5, 064	1, 270	29, 302	10, 059
Group 4. Florida, Georgia, North Carolina, and South Carolina	1, 561, 407	4, 272	27, 023	15, 260	1, 480, 440	5, 958	28, 461	14, 292
Group 5. Indiana and Kentucky	1, 146, 730	2, 440	13, 982	60, 559	1, 471, 983	4, 149	18, 755	37, 627
Illinois	452, 154	9, 738	921	10, 774	500, 995	2, 495	586	12, 129
Ohio	284, 666	16, 312	351	23, 228	260, 610	9, 146	193	35, 859
Group 6. Alabama, Mississippi, and Tennessee	7, 724	75, 127	10, 995	22, 293	9, 391	9, 963	16, 769	36, 705
Group 7. Michigan, Minnesota, and Wisconsin	545, 211	7, 378	1, 753	5, 314	699, 831	2, 483	2, 073	4, 520
Group 8. Iowa, Kansas, Missouri, and Nebraska	173, 069	2, 013	16, 738	54, 622	153, 609	5, 497	14, 099	41, 825
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	190, 529	8, 858	21, 578	26, 808	214, 250	4, 222	11, 801	27, 157
Group 10. Montana, North Dakota, South Dakota, and Wyoming	80, 524	4, 919	5, 971	29, 419	71, 928	5, 565	32, 422	25, 365
Group 11. Colorado, New Mexico, and Utah	21, 641	373	15, 925	13, 343	19, 977	497	27, 181	11, 280
Group 12. Alaska, Idaho, Oregon, and Washington		25, 205	68, 511	24, 403	59	61, 675	69, 711	19, 253
Group 13. Arizona, California, and Nevada			95, 006	79, 288			107, 881	104, 662
Total kegs	6, 190, 478	167, 700	309, 819	486, 652	7, 019, 550	174, 929	370, 442	513, 132
Grand total (kegs)	**7, 154, 649**				**8, 078, 053**			

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TABLE 3. *Amount of high explosives used in the United States during 1922 and 1923, classified by use*

Groups of States	High explosives other than permissible explosives							
	1922				1923			
	Coal mining	Other mining	Railway and other construction work	All other purposes	Coal mining	Other mining	Railway and other construction work	All other purposes
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont		27,708	801,090	1,583,589		13,196	1,201,396	1,696,778
Group 2. Connecticut, New Jersey, and New York		4,134,186	3,306,027	5,712,628		4,954,000	2,717,714	6,144,356
Group 3. Delaware, District of Columbia, Maryland, and Virginia	544,488	191,050	957,738	2,747,058	714,100	463,100	1,747,190	2,552,217
Pennsylvania	15,970,437	438,098	981,491	14,119,014	27,717,901	614,675	1,735,963	16,381,772
West Virginia	957,048		904,579	1,783,456	1,538,970		1,647,480	2,145,325
Group 4. Florida, Georgia, North Carolina, and South Carolina	40,000	1,103,921	2,495,931	3,755,380	56,050	1,608,962	2,811,975	4,497,490
Group 5. Indiana and Kentucky	1,211,586	93,050	546,525	2,623,126	1,577,589	375,100	2,037,025	3,162,269
Illinois	205,805	2,957,200	162,017	3,096,763	319,475	2,246,150	884,375	3,493,880
Ohio	1,065,768	328,974	114,707	5,739,062	1,128,008	531,069	2,220,716	5,048,556
Group 6. Alabama, Mississippi, and Tennessee	1,443,900	4,320,300	1,197,640	2,398,235	1,379,956	6,258,400	1,443,015	2,482,448
Group 7. Michigan, Minnesota, and Wisconsin	82,350	19,093,184	763,535	9,251,704	69,475	28,064,008	1,061,489	7,820,581
Group 8. Iowa, Kansas, Missouri, and Nebraska	1,782,962	8,211,082	759,208	4,738,253	1,982,220	9,336,853	1,552,560	5,572,671
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	648,304	8,769,725	1,361,085	3,577,527	176,800	11,380,875	1,646,094	4,165,034
Group 10. Montana, North Dakota, South Dakota, and Wyoming	372,575	5,944,260	200,400	714,237	430,600	6,201,505	678,505	1,693,611
Group 11. Colorado, New Mexico, and Utah	302,735	6,155,855	219,370	1,284,607	594,685	10,092,500	556,755	1,979,817
Group 12. Alaska, Idaho, Oregon, and Washington	866,700	4,500,925	3,713,318	8,798,026	141,100	5,809,560	3,517,583	11,832,845
Group 13. Arizona, California, and Nevada	3,100	11,804,971	3,949,545	11,546,966	2,050	17,053,947	4,470,186	11,972,670
Total (pounds)	25,497,758	78,074,489	22,434,206	83,469,631	37,828,979	105,003,900	31,930,021	92,642,320
Grand total (pounds)	**209,476,084**				**267,405,220**			

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TABLE 4. *Amount of permissible explosives used in the United States during 1922 and 1923, classified by use*

Groups of States	Permissible explosives							
	1922				1923			
	Coal mining	Other mining	Railway and other construction work	All other purposes	Coal mining	Other mining	Railway and other construction work	All other purposes
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Group 1. Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont				500		100	1, 600	1, 200
Group 2. Connecticut, New Jersey, and New York		204, 450	[1] 1, 000	50		201, 450	100	600
Group 3. Delaware, District of Columbia, Maryland, and Virginia	784, 600	63, 000	5, 600	60, 850	1, 056, 380	58, 700	2, 900	54, 625
Pennsylvania	18, 147, 722	45, 700	27, 600	448, 517	29, 975, 445	25, 450	23, 025	254, 505
West Virginia	8, 214, 968		73, 862	263, 889	10, 355, 335		114, 800	316, 000
Group 4. Florida, Georgia, North Carolina, and South Carolina	7, 700		350	4, 350	27, 350	125		40, 219
Group 5. Indiana and Kentucky	2, 180, 925	2, 900	850	93, 600	2, 614, 560	800	1, 050	205, 855
Illinois	2, 750, 125	200		7, 975	3, 413, 653		40, 700	400, 275
Ohio	4, 050	10, 800	16, 600	49, 919	56, 275	1, 900	4, 900	72, 425
Group 6. Alabama, Mississippi, and Tennessee	4, 572, 632	134, 100	7, 950	45, 812	5, 837, 375	27, 800	25, 650	51, 700
Group 7. Michigan, Minnesota, and Wisconsin		6, 150	200	141, 825		6, 050	2, 000	40, 200
Group 8. Iowa, Kansas, Missouri, and Nebraska	90, 350	50, 400	2, 550	26, 150	103, 100	92, 650	12, 100	24, 675
Group 9. Arkansas, Louisiana, Oklahoma, and Texas	424, 453	51, 250	11, 350	386, 245	210, 349	125, 950	21, 250	414, 906
Group 10. Montana, North Dakota, South Dakota, and Wyoming	349, 850	14, 350		4, 200	393, 187	59, 850		200, 450
Group 11. Colorado, New Mexico, and Utah	2, 105, 079	792, 250	[1] 100	35, 745	2, 071, 450	147, 050	21, 450	86, 650
Group 12. Alaska, Idaho, Oregon, and Washington	565, 485	16, 200	6, 950	49, 440	692, 050	5, 100	50, 700	267, 620
Group 13. Arizona, California, and Nevada		60, 750	1, 350	6, 150	200	30, 500	2, 000	25, 000
Total (pounds)	40, 197, 939	1, 452, 500	154, 112	1, 625, 217	56, 806, 709	783, 475	324, 225	2, 456, 905
Grand total (pounds)	43, 429, 768				60, 371, 314			

[1] Shipments returned to manufacturer.

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EXPLOSIVES IN COAL MINING

Mining operations generally consume about 75 per cent of all the explosives used in the United States. Coal mining consumes between 82 and 88 per cent of all black powder, from 77 to 93 per cent of permissible explosives used in this country, and 8 to 20 per cent of other high explosives. Other mining operations (excluding coal mines and oil and gas wells) normally consume 30 to 50 per cent of all high explosives other than permissibles, 2 to 18 per cent of permissible explosives, and 2 to 4 per cent of black powder. It will thus be seen that most of the mining explosives are used at coal mines. (Tables 13 and 14.)

One of the purposes of the Bureau of Mines in compiling statistics of explosives has been to show the extent to which permissible explosives were replacing other classes of explosives in mining operations and the influence of such replacement in reducing the number of mine accidents caused by explosives. It is interesting, therefore, to note the relative increase or decrease in the consumption of each of the three main classes of explosives at coal mines as compared with the production of coal. Comparative figures for 1923 and previous years, given in Table 5, show a most gratifying increase in the use of permissibles. The increase is even greater for anthracite mines than for bituminous mines.

Tables 6 and 7 show, for the different coal fields and regions, the annual production of coal and the quantities of each class of explosives sold for use in coal mining. It will be noted that in 1902 only 11,300 pounds of short-flame explosives were used in coal mining, indicating less than 1 pound of explosives of this class per 1,000 tons of coal produced, whereas in 1923 the quantity of permissible explosives so used was 56,806,709 pounds, or 89 pounds per 1,000 tons of coal.

In 1912 the quantity of permissibles consumed in the United States represented about 5 per cent of the total quantity of all kinds of explosives produced in this country, and in 1923 it was 11.3 per cent. The total amount of explosives used for the production of coal in 1923 was 270,124,438 pounds, of which 22.3 per cent was of the permissible class. (Tables 4, 5, 6, 7, and 14.) For every 1,000 tons of anthracite produced in 1917, 73 pounds of permissibles were used out of a total of 594 pounds of all classes of explosives; in 1923 the ratio was 153 pounds of permissibles out of 648 pounds. In 1917 at bituminous mines 47 pounds of permissibles were used out of 431 pounds of explosives of all kinds for every 1,000 tons of coal produced; the returns for 1923 show 77 pounds of permissibles out of a total of 382 pounds of all classes of explosives.

Tables 10, 11, and 12 indicate the proportionate amounts of black powder, permissibles, and other high explosives used for coal-mining work in each coal-producing State for the combined seven-year

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period 1917–1923. It will be noted (Table 8) that Arkansas, Iowa, and Kansas consume larger quantities of black powder per 1,000 tons of coal than any other States. Mining records also indicate that "shooting off the solid," that is, blasting coal without first undercutting it, is more prevalent in the three States named than elsewhere in the United States.

Table 9 shows the quantity of explosives used in the coal mines of each coal-producing State during each of the years 1921, 1922, and 1923. The data are presented in this form to enable anyone interested in the subject to learn more in detail the exact part of the United States where certain classes of explosives are being used for coal mining.

TABLE 5. *Yearly sales of explosives to coal mines compared with yearly production of coal*

Year	Production of coal (short tons)	Pounds of explosives sold to coal mines			Pounds of explosives used per 1,000 tons of coal mined [1]			
		Permissible explosives	High explosives	Black powder	Permissible explosives	High explosives	Black powder	Total
ALL COAL MINES								
1901	293, 299, 816							
1902	301, 590, 434	11, 300						
1903	357, 356, 416	288, 661			1			
1904	351, 816, 398	608, 270			2			
1905	392, 722, 635	1, 031, 300			3			
1906	414, 157, 278	1, 533, 575			4			
1907	480, 363, 424	2, 095, 244			4			
1908	415, 842, 698	2, 108, 610			5			
1909	460, 814, 616	8, 942, 857			19			
1910	501, 596, 378	11, 829, 836			24			
1911	496, 371, 126	13, 428, 239			27			
1912	534, 466, 580	18, 150, 618	20, 903, 430	187, 091, 000	34	39	350	423
1913	570, 048, 125	21, 804, 285	24, 143, 133	184, 917, 075	38	42	325	405
1914	513, 525, 477	19, 593, 892	24, 215, 945	176, 812, 650	38	47	345	430
1915	531, 619, 487	21, 841, 659	22, 384, 025	167, 513, 950	41	42	315	398
1916	590, 098, 175	26, 565, 521	20, 901, 405	176, 976, 025	45	35	300	380
1917	651, 402, 374	32, 910, 397	28, 262, 807	235, 750, 300	51	43	362	456
1918	678, 211, 904	37, 262, 915	31, 368, 073	216, 221, 550	55	46	319	420
1919	553, 952, 259	32, 840, 196	29, 616, 383	153, 490, 125	59	53	277	389
1920	658, 264, 932	45, 222, 130	37, 273, 255	219, 762, 625	69	56	334	459
1921	506, 395, 401	38, 055, 650	34, 231, 542	140, 335, 875	75	68	277	420
1922	476, 951, 121	40, 197, 939	25, 497, 758	154, 761, 950	84	53	324	461
1923	[2] 640, 846, 000	56, 806, 709	37, 828, 979	175, 488, 750	89	59	274	422
ANTHRACITE MINES								
1917	99, 611, 811	7, 298, 925	16, 074, 125	35, 769, 225	73	162	359	594
1918	98, 826, 084	7, 654, 250	16, 709, 256	30, 301, 800	77	169	307	553
1919	88, 092, 201	8, 579, 643	17, 800, 259	25, 467, 125	98	202	289	589
1920	89, 598, 249	8, 558, 690	19, 278, 375	23, 085, 575	95	215	258	568
1921	90, 473, 451	11, 921, 675	22, 832, 825	23, 861, 275	132	252	264	648
1922	54, 683, 022	7, 197, 596	12, 480, 611	12, 625, 300	132	228	231	591
1923	[2] 95, 444, 000	14, 597, 560	25, 539, 570	21, 743, 550	153	267	228	648
BITUMINOUS COAL MINES								
1917	551, 700, 563	25, 611, 472	12, 188, 682	199, 981, 075	47	22	362	431
1918	579, 385, 820	20, 608, 665	14, 658, 817	185, 919, 750	51	25	321	397
1919	465, 860, 058	24, 260, 553	11, 816, 124	128, 623, 000	52	25	275	352
1920	568, 696, 683	36, 663, 440	17, 994, 880	196, 677, 050	64	32	346	442
1921	415, 921, 950	26, 133, 975	11, 398, 717	116, 474, 600	63	27	280	370
1922	422, 238, 069	33, 000, 343	13, 017, 147	142, 136, 650	78	31	337	446
1923	[2] 545, 402, 000	42, 209, 149	12, 289, 409	153, 745, 200	77	23	282	382

[1] The figures show the relation that the consumption of each class of explosives bears to the total quantity of explosives used in producing coal; they do not indicate the quantity of coal broken down by any given quantity of explosives. The figures are the quotient obtained by dividing the total quantity of explosives used at all coal mines by the number of tons of coal produced at all mines in the United States.
[2] Estimated.

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TABLE 6. *Quantity of explosives used in the different coal fields in the United States*

Coal fields and regions [1]	Black blasting powder (kegs)							High explosives other than permissible (pounds)						
	1917	1918	1919	1920	1921	1922	1923	1917	1918	1919	1920	1921	1922	1923
1. Pennsylvania anthracite field	1,430,169	1,212,172	1,018,685	923,423	954,451	505,012	869,742	16,074,125	16,709,356	17,800,259	19,278,375	22,832,825	12,480,611	25,589,570
2. Northern Appalachian region [2]	2,372,303	1,967,012	1,529,511	2,271,648	1,086,831	1,671,186	1,762,666	4,592,547	5,320,401	4,561,368	6,975,482	4,828,967	6,057,130	5,569,409
3. Southern Appalachian region	845,553	815,785	656,037	1,050,068	623,094	1,065,868	905,702	1,519,234	2,202,700	1,867,150	3,221,212	1,971,317	2,045,550	2,290,206
4. Eastern interior field	2,974,925	3,034,820	1,876,849	3,037,925	2,054,752	1,937,438	2,321,786	994,166	1,121,958	904,826	1,360,150	1,063,702	938,091	1,172,339
5. Western interior field	1,478,311	1,319,401	838,599	1,186,280	669,789	718,280	853,440	3,185,290	4,067,393	3,642,960	4,778,831	2,680,231	2,431,266	2,159,020
6. Rocky Mountain region	304,544	279,039	206,099	294,657	198,315	271,053	286,178	1,154,495	1,347,240	596,170	847,009	635,050	675,310	1,025,285
7. Pacific coast region	24,207	20,633	13,825	26,504	26,203	21,641	20,036	742,950	599,125	243,650	812,196	219,450	869,800	143,150
Total	9,430,012	8,648,862	6,139,605	8,790,505	5,613,435	6,190,478	7,019,550	28,262,807	31,686,073	29,616,383	37,273,255	34,231,542	25,497,758	37,888,979

Coal fields and regions	Permissible explosives (pounds)											
	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
1. Pennsylvania anthracite field	2,177,172	3,294,225	4,380,635	5,037,050	5,219,032	7,298,925	7,654,250	8,579,643	8,558,690	11,921,675	7,197,596	14,597,560
2. Northern Appalachian region [2]	9,190,025	9,744,810	7,966,464	9,435,318	12,147,207	14,505,542	17,007,369	14,626,371	22,489,169	15,652,147	19,953,744	26,845,875
3. Southern Appalachian region	3,995,485	4,481,975	3,510,013	3,447,964	4,386,757	5,287,755	5,764,886	4,210,184	5,573,168	3,809,408	6,289,282	7,648,185
4. Eastern interior field	751,005	2,058,075	1,364,450	1,631,775	1,949,925	2,403,600	2,873,846	2,542,290	3,906,872	3,582,217	3,222,100	4,244,753
5. Western interior field	440,825	377,625	411,937	433,010	422,425	624,045	930,444	642,938	1,187,171	493,378	514,803	313,449
6. Rocky Mountain region	1,473,129	1,634,575	1,796,750	1,710,992	2,244,275	2,423,180	2,622,520	1,882,770	2,744,360	1,854,800	2,454,929	2,484,637
7. Pacific coast region	122,977	213,000	163,643	145,550	196,900	367,350	409,600	356,000	762,700	742,025	565,485	692,250
Total	18,150,618	21,804,285	19,593,892	21,841,659	26,566,521	32,910,397	37,262,915	32,840,196	45,222,130	38,055,650	40,197,939	56,806,709

[1] The various coal fields include the following States: Group 1 includes the Pennsylvania anthracite field only; Group 2 includes Pennsylvania bituminous, Maryland, West Virginia, Ohio, and Virginia; Group 3 includes Alabama, Georgia, North Carolina, Tennessee, and Kentucky; Group 4 includes Illinois, Indiana, and Michigan; Group 5 includes Iowa, Missouri, Arkansas, Texas, Oklahoma, and Kansas; Group 6 includes Colorado, Idaho, North Dakota, Montana, Utah, Wyoming, Nevada, South Dakota, and New Mexico; and Group 7 includes Alaska, California, Oregon, and Washington.

[2] Not including Pennsylvania anthracite field.

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TABLE 7. *Quantity of coal mined in different coal fields in the United States*

Coal fields and regions	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922
1. Pennsylvania anthracite field	84, 361, 598	91, 524, 922	90, 821, 507	88, 995, 061	87, 578, 493	99, 611, 811	98, 826, 084	88, 092, 201	89, 598, 249	90, 473, 451	54, 683, 022
2. Northern Appalachian region[1]	275, 991, 578	294, 898, 633	250, 627, 117	269, 876, 970	305, 651, 290	314, 471, 558	329, 086, 628	278, 019, 905	321, 900, 590	230, 063, 832	232, 304, 172
3. Southern Appalachian region	39, 292, 052	44, 454, 532	42, 085, 941	42, 154, 468	49, 791, 197	54, 189, 294	57, 696, 763	50, 846, 313	58, 708, 985	48, 674, 748	65, 474, 895
4. Eastern interior field	76, 377, 174	80, 016, 201	75, 513, 359	76, 991, 866	87, 469, 224	114, 113, 521	121, 434, 557	82, 771, 441	119, 565, 243	91, 063, 987	78, 530, 015
5. Western interior field	26, 580, 416	27, 875, 292	26, 396, 916	25, 684, 804	26, 474, 830	30, 707, 592	30, 723, 823	21, 741, 003	27, 677, 788	17, 112, 893	15, 233, 645
6. Rocky Mountain region	28, 449, 860	27, 327, 452	24, 950, 285	25, 434, 089	30, 031, 648	34, 209, 991	36, 266, 503	29, 411, 536	36, 972, 403	26, 462, 106	28, 038, 039
7. Pacific coast region	3, 413, 902	3, 951, 093	3, 130, 352	2, 482, 229	3, 101, 493	4, 098, 607	4, 177, 546	3, 069, 860	3, 841, 674	2, 544, 384	2, 687, 333
Total	**534, 468, 580**	**570, 048, 125**	**513, 525, 477**	**531, 619, 487**	**590, 098, 175**	**651, 402, 574**	**678, 211, 904**	**553, 952, 259**	**658, 364, 932**	**506, 395, 401**	**476, 951, 121**

[1] Not including Pennsylvania anthracite field.

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TABLE 8. *Consumption of explosives at coal mines per 1,000 tons of coal produced by States, during the 7-year period 1917–1923*

States	Production of coal, 7-year total 1917-1923 (tons)	Pounds of explosives used				Pounds per 1,000 tons of coal				Per cent			
		Black blasting powder	Permissible explosives	High explosives other than permissible	Total	Black blasting powder	Permissible explosives	High explosives other than permissible	Total	Black blasting powder	Permissible explosives	High explosives other than permissible	Total
Alabama	120,177,495	25,537,350	27,323,034	8,929,762	61,790,146	213	227	74	514	41.4	44.2	14.4	100.0
Alaska	[1] 527,271	50,250	139,900	447,200	637,350	95	266	848	1,209	7.9	22.0	70.1	100.0
Arkansas	11,641,387	14,016,725	511,996	693,585	15,222,306	1,204	44	60	1,308	92.0	3.4	4.6	100.0
California, Idaho, Nevada	[1] 34,868	5,975	5,800	5,150	16,925	171	166	148	485	35.3	34.2	30.5	100.0
Colorado	76,934,909	11,218,625	4,646,834	1,132,125	16,997,584	146	60	15	221	66.1	27.1	6.8	100.0
Georgia and North Carolina	[1] 601,112	552,575	37,700	329,200	919,875	920	63	547	1,530	60.1	4.1	35.8	100.0
Illinois	537,148,492	271,301,375	19,775,624	3,342,445	294,419,444	505	37	6	548	92.2	6.7	1.1	100.0
Indiana	173,932,234	157,654,100	2,999,304	3,576,101	164,229,505	906	17	21	944	96.0	1.8	2.2	100.0
Iowa	45,963,186	50,927,675	75,350	3,274,552	54,277,577	1,108	2	71	1,181	93.8	.2	6.0	100.0
Kansas	36,819,865	60,878,825	256,981	14,527,816	75,663,622	1,653	7	395	2,055	80.4	.4	19.2	100.0
Kentucky	239,869,856	101,062,175	8,968,228	3,734,637	113,765,040	421	37	16	474	88.8	7.8	3.4	100.0
Maryland	22,680,593	5,388,550	691,855	1,003,724	7,084,129	244	31	46	321	76.0	9.7	14.3	100.0
Michigan	8,597,038	2,006,900	250	636,686	2,643,836	234	----	74	308	76.0	----	24.0	100.0
Missouri	30,964,013	23,789,700	38,505	1,580,120	25,408,325	769	1	51	821	93.7	.1	6.2	100.0
Montana	25,015,608	13,269,900	108,000	768,145	14,146,045	530	4	31	565	93.8	.7	5.5	100.0
New Mexico	23,146,617	787,325	3,419,025	524,975	4,731,325	34	148	22	204	16.7	72.5	10.8	100.0
North Dakota	6,442,332	4,091,325	71,825	1,442,439	5,605,589	635	11	224	870	73.0	1.3	25.7	100.0
Ohio	267,213,117	83,322,650	146,520	5,613,985	89,083,155	312	----	21	333	93.7	----	6.3	100.0
Oklahoma	27,566,826	21,793,500	3,774,896	1,139,580	26,707,976	791	137	41	969	81.6	14.2	4.2	100.0
Oregon	[1] 161,111	12,650	10,250	31,200	54,100	78	64	194	336	23.2	19.1	57.7	100.0
Pennsylvania bituminous	1,061,527,134	108,716,700	76,355,284	19,774,668	204,846,652	102	72	19	193	52.9	37.3	9.8	100.0
South Dakota	[1] 66,183	53,275	500	12,075	65,850	80	1	18	99	80.8	1.0	18.2	100.0
Tennessee	40,338,002	21,960,175	2,253,906	2,063,770	26,217,851	542	56	51	649	83.5	8.6	7.9	100.0
Texas	11,091,467	5,196,075	48,500	1,729,338	6,973,913	469	4	156	629	74.6	.6	24.8	100.0
Utah	33,569,369	1,332,125	5,958,580	928,750	8,219,455	40	177	28	245	16.3	72.3	11.4	100.0
Virginia	70,065,887	17,165,175	3,585,676	3,373,925	24,124,776	245	51	48	344	71.2	14.8	14.0	100.0
Washington	22,799,541	3,757,350	3,739,460	3,146,771	10,643,581	165	164	138	467	35.3	35.1	29.6	100.0
West Virginia	598,759,954	101,935,850	50,300,882	8,129,002	160,365,734	170	84	14	268	63.4	31.4	5.2	100.0
Wyoming	56,236,706	15,244,550	2,242,432	1,472,050	18,959,032	271	40	26	337	80.4	11.9	7.7	100.0
Total bituminous	3,549,203,173	1,122,969,825	[2] 217,487,597	93,363,776	[2] 1,433,821,198	317	61	26	404	78.4	15.1	6.4	100.0
Pennsylvania anthracite	616,728,818	172,841,350	65,808,339	130,715,021	369,364,710	280	107	212	599	46.7	17.9	35.4	100.0
Grand total	4,166,021,991	1,295,811,175	[2] 283,295,936	224,078,797	[2] 1,803,185,908	311	68	54	433	71.8	15.7	12.5	100.0

[1] Coal production partly estimated.

[2] Includes 800 pounds reported sold for coal mining in Wisconsin. There are no coal mines in Wisconsin.

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TABLE 9. *Quantity of explosives used in* **coal mining** *during the years 1921, 1922, and 1923, by States and kinds of explosives*

States	1921			1922			1923		
	Black blasting powder	High explosives other than permissible	Permissible explosives	Black blasting powder	High explosives other than permissible	Permissible explosives	Black blasting powder	High explosives other than permissible	Permissible explosives
	Kegs	*Pounds*	*Pounds*	*Kegs*	*Pounds*	*Pounds*	*Kegs*	*Pounds*	*Pounds*
Alabama	110,171	1,352,975	2,564,008	165,127	1,161,400	4,204,407	136,688	1,065,436	5,249,525
Arkansas	52,189	123,525	43,479	46,266	166,824	30,950	59,330	70,700	9,800
Colorado	49,912	153,925	563,150	70,308	149,910	790,829	64,558	309,235	795,400
Illinois	1,279,988	535,803	3,164,504	1,146,730	205,805	2,750,125	1,471,983	319,475	3,413,653
Indiana	767,920	451,863	417,213	782,984	649,936	471,975	840,412	783,389	831,100
Iowa	226,992	503,793	4,250	223,658	270,050	19,450	296,436	341,125	49,750
Kansas	200,144	1,445,144	23,266	224,592	1,360,562	67,800	299,722	1,533,970	52,550
Kentucky	419,745	449,342	1,028,725	778,423	561,650	1,708,950	640,028	794,200	1,783,460
Maryland	8,737	83,175	42,425	20,337	85,638	186,650	25,999	139,350	163,630
Michigan	6,844	76,036	5,500	7,724	82,350	3,100	9,391	69,475	800
Missouri	101,044	147,400	15,800	96,961	152,350	17,850	103,673	107,125	12,350
Montana	52,263	29,100	359,250	85,531	35,075	472,200	94,537	31,525	430,750
New Mexico	4,177	35,850	4,350	5,252	30,125	37,700	3,110	28,250	28,975
North Dakota	21,575	186,600	22,725	31,845	292,950	4,050	40,007	193,125	56,275
Ohio	286,833	641,421	392,733	452,154	1,065,768	369,803	500,995	1,128,008	200,499
Oklahoma	68,387	131,275	9,043,944	98,018	136,105	10,950,126	72,391	77,400	15,377,885
Pennsylvania, bituminous	359,638	2,932,455	215,075	574,030	3,489,826	368,225	585,984	2,178,331	587,850
Tennessee	91,463	167,550	24,150	119,539	282,500	23,700	123,922	314,520	50
Texas	21,033	329,094	703,700	28,785	345,375	842,050	21,888	28,700	845,300
Utah	8,037	113,300	339,525	4,964	122,700	597,950	4,260	257,200	892,750
Virginia	51,000	318,075	718,475	101,462	458,850	518,935	97,637	574,750	624,850
Washington	26,157	217,850	6,203,528	19,754	817,750	8,214,968	19,917	108,250	10,355,335
West Virginia	380,623	853,841	208,550	523,203	957,048	294,300	552,051	1,538,970	351,362
Wyoming	61,926	114,550	25,650	73,143	40,650	54,250	79,686	205,950	95,250
Other States	2,186	4,775		4,676	95,950		5,203	90,950	
Total bituminous	4,658,984	11,398,717	26,133,975	5,685,466	13,017,147	33,000,343	6,149,808	12,289,409	42,209,149
Pennsylvania anthracite	954,451	22,832,825	11,921,675	505,012	12,480,611	7,197,596	869,742	25,539,570	14,597,560
Grand total	5,613,435	34,231,542	38,055,650	6,190,478	25,497,758	40,197,939	7,019,550	37,828,979	56,806,709

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DISTRIBUTION OF EXPLOSIVES, BY STATES, 1917–1923

Tables 10, 11, and 12 show the distribution, by States, of the sales of black powder, permissibles, and other high explosives, and the classes of work in which the explosives were used, during the combined seven-year period 1917–1923.

TABLE 10. *Amount of black blasting powder used in the United States during the seven-year period 1917–1923, classified by use*

(Kegs of 25 pounds each)

State	Quantity used for coal mining	Quantity used for other mining	Quantity used for railway and other construction work	Quantity used for all other purposes	Total
	Kegs	*Kegs*	*Kegs*	*Kegs*	*Kegs*
Alabama	1,021,494	62,293	61,209	57,370	1,202,366
Alaska	2,010	674	88,142	613	91,439
Arizona		65,524	88,761	33,792	188,077
Arkansas	560,669	22,561	16,707	11,251	611,188
California	239	12,672	403,628	282,817	699,356
Colorado	448,745	33,239	21,998	132,664	636,646
Connecticut		47	302	3,908	4,257
Delaware			311	391	702
Florida		5,219	1,784	8,060	15,063
Georgia	20,951	18,731	45,825	26,600	112,107
Idaho		1,978	59,164	26,354	87,496
Illinois	10,852,055	33,617	4,958	270,049	11,160,679
Indiana	6,306,164	6,452	6,488	141,685	6,460,789
Iowa	2,037,107	22,153	3,185	105,189	2,167,634
Kansas	2,435,153	3,543	26,280	74,240	2,539,216
Kentucky	4,042,487	40,761	84,742	305,955	4,473,945
Louisiana			231	1,650	1,881
Maine			141	12,510	12,651
Maryland	215,542	210	5,205	20,808	241,855
Massachusetts		2	350	22,154	22,506
Michigan	80,276	28,063	447	2,481	111,267
Minnesota		904,955	8,088	17,336	930,379
Mississippi			2,484	12,585	14,069
Missouri	951,588	49,011	49,396	174,688	1,224,683
Montana	530,796	42,616	51,600	127,454	752,526
Nebraska		1,350	7,195	12,611	21,156
Nevada		129,631	4,015	9,717	143,363
New Hampshire		49	2	2,768	2,819
New Jersey			1,706	11,850	13,556
New Mexico	31,493	30,567	13,466	22,910	98,436
New York		15,982	3,029	78,269	97,280
North Carolina	1,108	6,609	96,953	42,487	147,217
North Dakota	163,653	410	3,495	57,230	224,788
Ohio	3,332,906	97,975	17,337	236,047	3,684,265
Oklahoma	871,740	3,410	40,918	58,369	974,437
Oregon	506	670	148,118	66,249	215,543
Pennsylvania (Anthracite)	6,913,654	42,111	107,906	1,182,623	12,594,902
Pennsylvania (Bituminous)	4,348,668				
Rhode Island			23	1,568	1,591
South Carolina		413	11,435	5,137	16,985
South Dakota	2,131	4,670	671	8,825	16,297
Tennessee	876,007	26,843	53,161	98,358	1,054,369
Texas	207,843	5,747	51,129	102,103	366,822
Utah	53,285	13,518	70,002	28,388	165,193
Vermont		642	21	25,014	25,677
Virginia	686,607	7,059	32,530	42,701	768,897
Washington	150,294	4,487	99,108	69,210	325,099
West Virginia	4,077,434	15,017	129,899	178,802	4,401,152
Wisconsin		1,933	1,288	18,725	21,946
Wyoming	609,782	39,381	55,987	152,095	857,245
Total	51,832,447	1,802,795	1,980,470	4,384,750	60,000,462

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TABLE 11. *Amount of high explosives used in the United States during the seven-year period 1917–1923, classified by use*

State	Quantity used for coal mining	Quantity used for other mining	Quantity used for railway and other construction work	Quantity used for all other purposes	Total
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Alabama	8,929,762	25,013,613	1,903,033	6,211,365	42,057,773
Alaska	447,300	16,972,535	2,204,950	645,185	20,269,870
Arizona		66,175,271	1,528,600	3,986,447	71,690,318
Arkansas	693,585	2,121,019	3,657,502	5,113,573	11,585,679
California	5,150	24,603,841	19,843,361	47,389,831	91,842,183
Colorado	1,132,125	14,635,810	591,165	15,974,224	32,333,324
Connecticut		21,700	769,382	3,247,615	4,038,697
Delaware			86,096	279,489	365,585
Florida		3,750,846	3,392,424	8,731,815	15,875,085
Georgia	215,500	642,832	1,534,570	3,497,440	5,890,342
Idaho		16,497,630	1,917,515	7,271,940	25,687,085
Illinois	3,342,445	12,838,050	2,314,572	18,076,570	36,571,637
Indiana	3,576,101	229,505	912,925	11,419,165	16,137,696
Iowa	3,274,552	1,460,650	795,148	8,309,554	13,839,904
Kansas	14,527,816	16,586,267	1,294,256	6,200,494	38,608,833
Kentucky	3,734,637	1,244,976	4,827,393	6,101,632	15,908,638
Louisiana		207,000	1,297,446	4,981,672	6,486,118
Maine		10,400	250,669	3,611,448	3,872,517
Maryland	1,003,724	201,675	806,631	7,227,091	9,239,121
Massachusetts		41,025	1,133,417	3,156,254	4,330,696
Michigan	636,686	119,305,990	1,796,585	23,332,129	145,071,390
Minnesota		59,770,404	1,901,179	10,627,438	72,299,021
Mississippi		2,250	2,143,275	2,245,710	4,391,235
Missouri	1,580,120	48,361,170	3,466,149	12,886,835	66,294,274
Montana	768,145	33,801,107	826,514	5,033,227	40,428,993
Nebraska			243,675	1,043,394	1,287,069
Nevada		20,524,220	199,910	6,519,390	27,243,520
New Hampshire		86,454	130,289	844,081	1,060,824
New Jersey		8,198,962	819,708	6,454,127	15,472,797
New Mexico	524,975	14,242,254	292,800	1,358,630	16,418,659
New York		22,200,825	11,623,095	24,790,620	58,614,540
North Carolina	113,700	1,426,800	4,796,113	7,407,248	13,743,861
North Dakota	1,442,439	20,200	44,250	739,981	2,246,870
Ohio	5,613,985	2,232,310	3,837,925	35,376,162	47,060,382
Oklahoma	1,139,580	55,551,273	1,494,800	6,261,835	64,447,488
Oregon	31,200	1,067,790	8,948,653	17,590,164	27,637,807
Pennsylvania (Anthracite)	130,715,021	3,044,942	8,484,082	96,854,699	258,873,412
Pennsylvania (Bituminous)	19,774,668				
Rhode Island		5,700	435,738	427,637	869,075
South Carolina		30,125	1,034,735	1,912,557	2,977,417
South Dakota	12,075	7,345,868	122,625	1,177,476	8,658,044
Tennessee	2,063,770	6,859,073	4,049,491	6,342,877	19,315,211
Texas	1,729,338	1,800,535	1,421,809	7,767,143	12,718,825
Utah	928,750	18,895,053	578,900	6,988,143	27,390,846
Vermont		218,250	1,037,425	1,696,474	2,952,149
Virginia	3,373,925	2,526,625	4,265,147	10,234,751	20,400,448
Washington	3,146,771	1,248,765	9,716,860	33,506,578	47,618,974
West Virginia	8,129,002	162,275	6,462,071	14,678,127	29,431,775
Wisconsin		14,197,585	892,631	22,957,322	38,047,538
Wyoming	1,472,050	1,164,000	866,070	841,070	4,343,190
Total	224,078,797	647,545,250	132,993,559	539,328,929	1,543,946,535

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TABLE 12. *Amount of permissible explosives used in the United States during the seven-year period 1917–1923, classified by use*

State	Quantity used for coal mining	Quantity used for other mining	Quantity used for railway and other construction work	Quantity used for all other purposes	Total
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Alabama	27,323,034	401,007	29,268	219,412	27,972,727
Alaska	139,900	48,350	74,100	34,600	296,950
Arizona		451,200		68,750	519,950
Arkansas	511,996	14,450	26,954	216,248	769,648
California	5,800	32,360	6,650	46,285	91,095
Colorado	4,646,834	94,850	19,925	1,106,605	5,868,214
Connecticut		750		200	950
Delaware				1,700	1,700
Florida		237,075	1,350	87,510	325,935
Georgia	100	2,100		572,534	574,734
Idaho		7,400	10,300	5,850	23,550
Illinois	19,775,624	168,875	46,750	517,690	20,508,939
Indiana	2,999,304	13,200	3,975	395,500	3,411,979
Iowa	75,350	61,820	1,400	24,475	163,045
Kansas	256,981	220,400	3,100	218,788	699,269
Kentucky	8,968,228	62,125	28,013	493,305	9,551,671
Louisiana		61,450	6,900	945,401	1,013,751
Maryland	691,855	37,050		202,225	931,130
Massachusetts			50	15,900	15,950
Michigan	250	191,800		122,700	314,750
Minnesota		6,150	200	800	7,150
Mississippi			37,000	130,390	167,390
Missouri	38,505	144,800	39,075	935,884	1,158,264
Montana	108,000	174,480	2,850	42,900	328,230
Nebraska			100	5,947	6,047
Nevada		5,250		7,700	12,950
New Hampshire		600	1,550		2,150
New Jersey		700	550	33,375	34,625
New Mexico	3,419,025	493,250	30,600	97,400	4,040,275
New York		3,358,265	1,600	133,975	3,493,840
North Carolina	37,600	3,250	2,000	9,450	52,300
North Dakota	71,825		2,925	3,300	78,050
Ohio	146,520	26,700	23,600	555,252	752,072
Oklahoma	3,774,896	654,300	36,262	355,846	4,821,304
Oregon	10,250	250	25,050	133,350	168,900
Pennsylvania (Anthracite)	65,808,339	99,850	157,727	7,891,711	150,312,911
Pennsylvania (Bituminous)	76,355,284				
South Carolina				3,240	3,240
South Dakota	500	10,500			11,000
Tennessee	2,253,906	464,700	67,550	196,755	2,982,911
Texas	48,500	213,700	21,400	543,478	827,078
Utah	5,958,580	11,515,200	165,800	430,330	18,069,910
Vermont				2,450	2,450
Virginia	3,585,676	264,950	36,100	303,025	4,189,751
Washington	3,739,460	115,600	88,210	340,710	4,283,980
West Virginia	50,300,882	138,750	479,421	3,671,692	54,590,745
Wisconsin	[1] 500		2,000	132,375	134,875
Wyoming	2,242,432	221,250		786,550	3,250,232
Total	283,295,936	20,018,757	1,480,305	22,043,563	326,838,561

[1] Erroneously reported for coal mining; there is no coal mining in Wisconsin.

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TABLE 13. *Percentage of explosives used for various purposes in the United States during the years 1915 to 1923*

	Coal mining	Other mining	Railway and other construction work	All other purposes	Total
1923	*Per cent*	*Per cent*	*Per cent*	*Per cent*	*Per cent*
Black blasting powder	86.9	2.2	4.6	6.3	100.00
High explosive	14.2	39.3	11.9	34.6	100.00
Permissible explosives	94.1	1.3	.5	4.1	100.00
Total	51.0	20.8	7.8	20.4	100.00
1922					
Black blasting powder	86.5	2.4	4.3	6.8	100.00
High explosives	12.2	37.3	10.7	39.8	100.00
Permissible explosives	92.6	3.3	.4	3.7	100.00
Total	51.1	19.4	7.0	22.5	100.00
1921					
Black blasting powder	87.7	2.9	2.5	6.9	100.00
High explosives	20.0	29.8	10.7	39.5	100.00
Permissible explosives	92.5	2.1	.7	4.7	100.00
Total	57.1	15.2	6.1	21.6	100.00
1920					
Black blasting powder	86.2	3.4	1.9	8.5	100.00
High explosives	16.3	38.9	6.6	38.2	100.00
Permissible explosives	83.8	6.9	.5	8.8	100.00
Total	56.2	18.9	3.7	21.2	100.00
1919					
Black blasting powder	85.0	3.5	2.8	8.7	100.00
High explosives	14.9	45.3	6.4	33.4	100.00
Permissible explosives	84.5	6.4	.5	8.6	100.00
Total	51.7	23.6	4.3	20.4	100.00
1918					
Black blasting powder	87.7	3.0	2.2	7.1	100.00
High explosives	15.2	49.6	5.8	29.4	100.00
Permissible explosives	80.9	9.9	.4	8.8	100.00
Total	57.1	22.9	3.5	16.5	100.00
1917					
Black blasting powder	85.1	3.4	4.7	6.8	100.00
High explosives	10.8	50.4	7.8	31.0	100.00
Permissible explosives	76.5	14.2	.2	9.1	100.00
Total	51.0	25.4	5.7	17.9	100.00
1916					
Black blasting powder	82.1	3.6	5.0	9.3	100.00
High explosives	8.2	51.6	8.6	31.6	100.00
Permissible explosives	76.6	17.9	.3	5.2	100.00
Total	44.4	28.8	6.5	20.3	100.00
1915					
Black blasting powder	84.8	3.4	3.6	8.2	100.00
High explosives	9.5	46.3	9.4	34.9	100.00
Permissible explosives	79.9	17.1	.5	2.5	100.00
Total	45.9	26.1	6.4	21.5	100.00

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TABLE 14. *Production of explosives in the United States from 1913 to 1923*

[Excluding exports]

	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
Black blasting powder (kegs of 25 pounds):											
Quantity used for coal mining	7,396,683	7,072,506	6,700,558	7,079,041	9,430,012	8,648,862	6,139,605	8,790,505	5,613,435	6,190,478	7,019,550
Quantity used for other mining	334,014	302,885	268,146	313,851	378,199	297,818	252,134	347,223	184,792	167,700	174,929
Quantity used for railway and other construction work	626,474	316,131	289,869	428,853	516,892	219,260	204,197	196,172	163,688	309,819	370,442
Quantity used for all other purposes	840,410	552,466	650,319	801,256	759,638	700,594	624,506	861,293	438,935	486,652	513,132
Total	**9,197,581**	**8,243,988**	**7,908,892**	**8,623,001**	**11,084,741**	**9,866,534**	**7,220,442**	**10,195,193**	**6,400,850**	**7,154,649**	**8,078,053**
Black blasting powder (pounds):											
Quantity used for coal mining	184,917,075	176,812,650	167,513,950	176,976,025	235,750,300	216,221,550	153,490,125	219,762,625	140,335,875	154,761,950	175,488,750
Quantity used for other mining	8,350,350	7,572,125	6,703,650	7,846,275	9,454,975	7,445,450	6,303,350	8,680,575	4,619,800	4,192,500	4,373,225
Quantity used for railway and other construction work	15,661,850	7,903,275	7,246,725	10,721,325	12,922,300	5,481,500	5,104,925	4,904,300	4,092,200	7,745,475	9,261,050
Quantity used for all other purposes	21,010,250	13,811,650	16,257,975	20,031,400	18,990,950	17,514,850	15,612,650	21,532,325	10,973,375	12,166,300	12,828,300
Total	**229,939,525**	**206,099,700**	**197,722,300**	**215,575,025**	**277,118,525**	**246,663,350**	**180,511,050**	**254,873,825**	**160,021,250**	**178,866,225**	**201,951,325**
High explosives other than permissible (pounds):											
Quantity used for coal mining	24,143,133	24,215,945	22,384,025	20,901,405	28,262,807	31,368,073	29,616,383	37,273,255	34,231,542	25,497,758	37,828,979
Quantity used for other mining	92,096,426	84,264,577	109,128,966	131,753,648	132,235,515	102,366,876	89,754,788	89,132,316	50,977,366	78,074,489	105,003,900
Quantity used for railway and other construction work	33,173,805	27,983,946	22,279,699	21,905,376	20,418,227	12,081,541	12,750,023	15,052,608	18,317,333	22,434,206	31,930,021
Quantity used for all other purposes	92,973,180	81,989,503	82,035,897	80,594,358	81,399,531	60,599,587	66,137,704	87,653,905	67,426,161	83,469,631	92,642,320
Total	**242,386,544**	**218,453,971**	**235,828,587**	**255,154,787**	**262,316,080**	**206,416,077**	**198,268,588**	**229,112,084**	**170,952,402**	**209,476,084**	**267,405,220**

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Permissible explosives (pounds):											
Quantity used for coal mining	21,804,285	19,593,892	21,841,659	26,566,521	32,910,397	37,262,915	32,840,196	45,222,130	38,055,650	40,197,999	56,806,709
Quantity used for other mining	4,735,480	4,850,241	4,687,510	6,206,558	6,102,225	4,550,130	2,498,132	3,750,585	881,710	1,452,500	783,475
Quantity used for railway and other construction work	424,575	281,425	139,843	97,100	106,185	183,380	183,353	266,505	262,545	154,112	824,225
Quantity used for all other purposes	721,430	972,260	680,897	1,815,061	3,921,915	4,048,808	3,333,151	4,723,621	1,933,946	1,625,217	2,456,905
Total	**27,685,770**	**25,697,818**	**27,349,909**	**34,685,240**	**43,040,722**	**46,045,233**	**38,854,832**	**53,962,841**	**41,133,851**	**43,429,768**	**60,871,314**
Grand total (pounds):											
Quantity used for coal mining	230,864,493	220,622,487	211,739,634	224,443,951	296,923,504	284,852,538	215,946,704	302,258,010	212,623,067	220,457,647	270,124,438
Quantity used for other mining	105,182,256	96,686,943	120,520,126	145,806,481	147,792,715	114,362,456	98,556,270	101,563,476	56,478,876	83,719,489	110,160,600
Quantity used for railway and other construction work	49,260,230	36,168,646	29,666,267	32,723,801	33,446,712	17,746,421	18,047,901	20,223,413	22,672,078	30,333,793	41,515,296
Quantity used for all other purposes	114,704,860	96,773,413	98,974,769	102,440,819	104,312,396	82,163,245	85,083,595	113,909,851	80,333,482	97,261,148	107,927,525
Total	**500,011,839**	**450,251,489**	**460,900,796**	**505,415,052**	**582,475,327**	**499,124,660**	**417,634,470**	**537,954,750**	**372,107,503**	**431,772,077**	**529,727,859**

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MONTHLY SALES OF EXPLOSIVES

Tables 15 and 16 show the monthly fluctuations in the sales of explosives during the past four years. They are based mainly on monthly reports by manufacturers who are members of the Institute of Makers of Explosives, although the figures for 1922 and 1923 include some companies not members of the institute. The figures for 1923 are for companies whose sales represented about 85 per cent of all sales of black blasting powder, 81 per cent of high explosives (other than permissibles), and over 89 per cent of permissible explosives. Reports from most nonmembers are received by the Bureau of Mines in the form of an annual summary, hence the data for those companies could not be segregated on a monthly basis.

The standard chosen for purposes of comparison was the average monthly sales during the year, and this quantity was rated at 100. The sales for each month were then calculated as a certain percentage of this standard.

Since nearly all the black powder and permissibles used in the United States are consumed at coal mines, the fluctuations in the monthly sales of these two classes of explosives follow closely those in the monthly production of coal.

Table 17 shows the monthly fluctuations of sales of explosives during 1923 with reference to the purposes for which the explosives were used.

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TABLE 15. *Monthly sales of explosives in 1923, by uses* [1]

[Excluding exports]

	January	February	March	April	May	June	July	August	September	October	November	December
Black blasting powder kegs of 25 pounds):	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*	*Kegs*
Quality used for coal mining	749, 124	522, 723	540, 297	511, 437	413, 640	436, 712	438, 469	470, 978	492, 830	527, 490	484, 306	441, 222
Quantity used for other mining	6, 941	8, 886	8, 263	15, 701	12, 095	21, 189	14, 412	16, 314	19, 092	18, 934	15, 275	7, 486
Quantity used for railway and other construction work	26, 274	26, 004	23, 048	26, 183	37, 691	35, 946	28, 932	32, 779	34, 371	30, 908	33, 031	24, 284
Quantity used for all other purposes	34, 354	30, 943	35, 170	45, 301	39, 321	35, 850	34, 972	57, 027	38, 408	47, 119	36, 915	29, 895
Total	816, 693	588, 556	606, 778	598, 622	502, 747	529, 697	516, 785	577, 098	584, 701	624, 451	569, 527	502, 837
Black blasting powder:	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Quantity used for coal mining	18, 728, 100	13, 068, 075	13, 507, 425	12, 785, 925	10, 341, 000	10, 917, 800	10, 961, 725	11, 774, 450	12, 320, 750	13, 187, 250	12, 107, 650	11, 030, 550
Quantity used for other mining	173, 525	222, 150	206, 575	392, 525	302, 375	529, 725	360, 300	407, 850	477, 300	473, 350	381, 875	187, 150
Quantity used for railway and other construction work	656, 850	650, 100	576, 200	654, 575	942, 275	898, 650	723, 300	819, 475	859, 275	772, 700	825, 775	605, 850
Quantity used for all other purposes	858, 850	773, 575	879, 250	1, 132, 525	983, 025	896, 250	874, 300	1, 425, 675	960, 200	1, 177, 975	922, 875	747, 375
Total	20, 417, 325	14, 713, 900	15, 169, 450	14, 965, 550	12, 568, 675	13, 242, 425	12, 919, 625	14, 427, 450	14, 617, 525	15, 611, 275	14, 238, 175	12, 570, 925
High explosives other than permissible:												
Quantity used for coal mining	3, 180, 860	2, 958, 685	2, 993, 937	3, 584, 464	2, 916, 952	2, 770, 188	2, 796, 975	2, 877, 024	1, 852, 171	3, 008, 337	2, 588, 649	2, 586, 753
Quantity used for other mining	6, 427, 135	6, 443, 545	6, 516, 817	8, 040, 600	7, 068, 150	6, 581, 450	5, 918, 930	6, 472, 200	6, 689, 390	6, 436, 400	6, 502, 115	5, 910, 140
Quantity used for railway and other construction work	1, 339, 158	1, 513, 089	2, 106, 136	2, 177, 032	2, 248, 875	2, 257, 857	2, 079, 862	2, 859, 868	2, 040, 898	2, 053, 845	1, 912, 211	1, 355, 853
Quantity used for all other purposes	4, 150, 239	4, 773, 145	6, 089, 613	8, 308, 675	8, 221, 303	6, 606, 790	5, 963, 160	7, 623, 113	6, 626, 173	6, 646, 812	5, 595, 139	4, 644, 491
Total	15, 097, 392	15, 688, 465	17, 706, 503	22, 110, 771	20, 455, 280	18, 216, 285	16, 758, 927	19, 832, 205	17, 208, 632	18, 145, 394	16, 598, 114	14, 497, 237
Permissible explosives:												
Quantity used for coal mining	5, 018, 720	4, 207, 473	4, 182, 719	5, 010, 350	4, 478, 350	4, 095, 975	4, 034, 307	4, 185, 393	3, 914, 118	4, 274, 674	3, 840, 870	3, 540, 625
Quantity use for other mining	87, 900	32, 050	39, 750	61, 800	53, 850	71, 900	32, 050	63, 950	60, 900	33, 600	104, 750	16, 525
Quantity use for railway and other construction work	64, 925	19, 150	9, 000	26, 300	9, 750	33, 075	11, 225	29, 050	12, 850	18, 425	37, 875	44, 400
Quantity used for all other purposes	158, 750	118, 735	216, 475	263, 985	298, 100	241, 225	100, 250	185, 437	81, 600	195, 038	121, 400	92, 335
Total	5, 330, 295	4, 377, 408	4, 447, 944	5, 362, 435	4, 840, 050	4, 442, 175	4, 177, 832	4, 463, 830	4, 069, 483	4, 521, 737	4, 104, 895	3, 693, 885
Grand total:												
Quantity used for coal mining	26, 927, 680	20, 234, 234	20, 684, 081	21, 380, 739	17, 736, 302	17, 783, 963	17, 793, 007	18, 836, 867	18, 087, 039	20, 470, 261	18, 537, 169	17, 157, 928
Quantity used for other mining	6, 688, 560	6, 697, 745	6, 763, 142	8, 494, 925	7, 424, 375	7, 183, 075	6, 311, 280	6, 944, 000	7, 227, 590	6, 943, 350	6, 988, 740	6, 113, 815
Quantity used for railway and other construction work	2, 060, 933	2, 182, 339	2, 691, 336	2, 857, 907	3, 200, 900	3, 189, 582	2, 814, 387	3, 708, 393	2, 913, 023	2, 844, 970	2, 775, 861	2, 006, 103
Quantity used for all other purposes	5, 167, 839	5, 665, 455	7, 185, 338	9, 705, 185	9, 502, 428	7, 744, 265	6, 937, 710	9, 234, 225	7, 667, 973	8, 019, 825	6, 639, 414	5, 484, 201
Total	40, 845, 012	34, 779, 773	37, 323, 897	42, 438, 756	37, 864, 005	35, 900, 885	33, 856, 384	38, 723, 485	35, 895, 625	38, 278, 406	34, 941, 184	30, 762, 047

[1] The monthly sales of explosives in 1923 add to less than the total sales shown for the year because several manufacturers did not report their sales on a monthly basis.

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TABLE 16. *Monthly fluctuations in sales of explosives and in production of coal, 1920–1923*

[Average monthly quantities equal 100 per cent]

Month	Sales of explosives			Production of coal		
	Black blasting powder	"High" explosives	Permissible explosives	Bituminous	Anthracite	Total
1923						
January	121.3	67.8	106.0	110.4	109.5	110.3
February	87.4	70.4	87.0	92.8	97.7	93.5
March	90.1	79.5	88.4	102.0	118.0	105.2
April	88.9	99.2	105.6	93.7	101.4	94.8
May	74.7	91.8	96.2	101.4	107.8	102.3
June	78.7	81.7	88.3	100.1	108.9	101.4
July	76.8	75.2	83.0	99.3	104.6	100.1
August	85.7	89.0	88.7	107.5	111.5	108.1
September	86.9	77.2	80.9	101.7	36.7	92.0
October	92.8	81.4	89.9	108.2	109.7	108.4
November	84.6	74.5	81.6	94.4	97.4	94.9
December	74.7	65.1	73.4	87.6	96.8	89.0
1922						
January	100.1	73.9	86.8	110.6	143.1	114.3
February	105.8	76.5	103.3	120.6	154.6	124.4
March	84.7	88.6	106.3	147.6	200.2	153.6
April	36.5	93.2	51.5	46.4	.6	41.2
May	54.0	100.1	44.8	59.7	.8	53.0
June	58.2	94.3	74.2	65.6	1.9	58.4
July	62.3	99.5	64.6	50.0	2.7	44.6
August	118.9	119.7	101.7	80.5	3.7	71.7
September	160.4	117.1	151.9	116.2	111.9	115.7
October	156.1	119.8	145.5	132.8	198.1	140.0
November	140.8	116.1	143.1	133.3	191.7	139.9
December	122.4	101.1	126.3	136.7	192.7	143.0
1921						
January	109.3	93.0	128.8	118.7	100.6	115.4
February	87.5	92.3	83.8	90.9	104.5	93.3
March	80.2	105.0	83.0	89.5	100.5	91.5
April	80.4	108.4	78.8	81.2	104.5	85.3
May	88.2	105.6	99.3	98.2	104.1	99.3
June	103.7	97.0	105.0	99.9	112.0	102.0
July	91.5	89.1	93.5	89.5	95.7	90.6
August	109.4	106.1	100.8	101.8	103.9	102.2
September	113.4	110.4	98.6	103.5	96.7	102.3
October	132.2	114.0	126.7	128.9	102.9	124.2
November	118.6	93.0	106.1	106.1	93.1	103.8
December	85.1	85.6	95.3	91.3	81.2	89.5
1920						
January	109.1	87.9	99.9	105.0	102.2	104.6
February	99.4	103.1	87.1	86.5	87.9	86.7
March	107.6	126.7	98.4	100.9	105.8	101.6
April	74.6	107.0	82.3	81.8	83.8	82.1
May	95.2	108.8	94.7	85.7	107.2	88.7
June	114.7	107.5	98.8	94.4	110.0	96.5
July	109.2	93.7	103.5	96.2	111.3	100.0
August	108.8	120.6	113.3	104.3	108.1	104.8
September	92.6	105.1	116.6	106.1	[1] 62.6	100.1
October	108.4	94.5	115.1	113.5	108.7	112.8
November	91.3	74.4	94.3	110.0	100.4	108.7
December	89.1	70.7	96.2	113.7	112.1	113.5

[1] A strike in the anthracite field restricted output.

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TABLE 17. *Monthly fluctuations in sales of explosives in 1922 and 1923, by uses*

[Average monthly quantities equal 100 per cent]

Month	1922				1923			
	Coal mining	Other mining	Railway and other construction work	All other purposes	Coal mining	Other mining	Railway and other construction work	All other purposes
BLACK BLASTING POWDER								
January	104.71	72.79	47.18	91.99	149.09	51.73	87.72	88.60
February	111.33	86.72	58.65	79.71	104.03	66.23	86.82	79.80
March	88.59	68.81	71.68	53.26	107.53	61.59	76.95	90.70
April	31.00	68.70	89.03	54.41	101.79	117.03	87.42	116.83
May	44.85	140.23	111.67	90.92	82.32	90.15	125.84	101.41
June	47.92	145.80	119.51	105.18	86.91	157.93	120.02	92.46
July	53.45	150.81	105.94	104.15	87.26	10.74	96.60	90.19
August	114.90	141.06	137.00	144.67	93.73	121.60	109.44	147.07
September	165.82	113.00	110.88	146.67	98.06	142.30	114.76	99.05
October	161.85	88.55	136.57	126.56	104.98	141.12	103.19	121.52
November	147.33	60.40	114.03	111.19	96.39	113.85	110.28	95.20
December	128.26	63.11	97.87	91.31	87.81	55.79	80.91	77.19
HIGH EXPLOSIVES								
January	115.43	72.85	62.51	64.46	111.88	97.61	67.11	66.18
February	136.46	76.63	68.84	58.63	104.07	97.86	75.82	76.11
March	129.80	89.68	81.63	75.74	105.31	98.98	105.55	97.11
April	26.88	86.87	83.29	126.09	126.08	122.12	109.10	132.49
May	26.29	96.83	106.80	126.69	102.60	107.35	112.70	131.10
June	35.61	96.64	98.58	110.33	97.44	99.96	113.15	105.35
July	35.37	104.42	109.88	112.29	96.38	89.89	104.23	95.09
August	53.41	120.34	162.20	127.42	101.19	98.30	143.32	121.56
September	142.16	114.93	131.72	106.27	65.15	101.60	102.28	105.66
October	171.78	109.95	113.53	115.32	105.81	97.75	102.92	105.99
November	162.17	118.57	97.57	103.77	91.05	98.75	95.83	89.22
December	164.63	112.28	82.46	72.99	90.98	89.76	67.94	74.06
PERMISSIBLES								
January	90.86	2.05	64.53	85.82	118.59	160.05	246.53	91.88
February	107.62	33.76	78.45	78.66	99.42	58.35	72.71	68.72
March	108.71	52.33	146.56	105.47	98.83	72.37	34.17	225.29
April	47.38	55.96	122.94	140.27	118.39	112.52	99.86	152.78
May	40.93	101.04	29.52	77.44	105.82	98.05	37.02	172.53
June	70.24	181.12	81.08	49.10	96.78	130.92	125.59	139.61
July	59.89	151.10	50.19	83.05	95.32	58.35	42.62	58.02
August	96.39	165.89	162.17	153.62	98.89	116.44	110.30	107.32
September	148.83	192.46	47.66	192.49	92.48	110.89	48.79	47.22
October	152.87	51.55	219.52	62.53	101.00	61.18	69.96	112.88
November	147.34	83.66	68.75	113.73	90.75	190.73	143.82	70.26
December	128.94	128.61	128.64	57.80	83.66	30.08	168.59	53.44

CAPACITY OF MILLS

Reports from manufacturers whose sales of black powder in 1923 represented about 77 per cent of the total sales by all companies showed that their plants ran at 51 per cent of capacity during the year. Similar information from manufacturers of permissibles and other high explosives, whose sales represented 79 per cent of this branch of the explosives industry, showed that the quantity of explosives manufactured during 1923 was 63 per cent of the capacity of the mills reporting. The monthly fluctuations in the quantities of explosives manufactured, sales, shipments, and stocks are shown in Table 18.

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TABLE 18. *Relation between quantity of explosives manufactured and sold and mill capacity in 1923* [1]

BLACK BLASTING POWDER

[Quantities in kegs]

	January	February	March	April	May	June	July	August	September	October	November	December	Total
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Capacity	1,040,999	1,053,583	1,053,583	1,053,583	1,053,583	1,053,583	1,053,583	1,053,583	1,053,583	1,053,583	1,053,583	1,058,583	12,635,412
Manufactured	682,484	619,604	538,450	517,611	518,894	445,191	424,536	524,211	504,789	605,965	525,946	481,532	6,389,213
Percentage of capacity	65.56	58.81	51.10	49.13	49.25	42.25	40.29	49.76	47.91	57.51	49.92	45.49	50.57
Shipments	691,121	546,705	521,896	546,999	455,893	479,610	450,803	528,768	504,061	585,365	497,295	471,273	6,279,789
Percentage of capacity	66.39	51.89	49.54	51.92	43.27	45.52	42.79	50.19	47.84	55.56	47.20	44.52	49.70
Sales	705,328	521,163	529,243	535,446	453,032	475,842	454,386	519,733	509,334	553,479	503,306	450,375	6,210,667
Percentage of capacity	67.75	49.47	50.23	50.82	43.00	45.16	43.13	49.33	48.34	52.53	47.77	42.55	49.15
Stocks, end of month	396,789	469,913	485,068	455,584	519,930	485,870	461,313	456,644	459,307	476,713	504,557	518,140	518,140
Percentage of capacity	38.12	44.60	46.04	43.24	49.35	46.12	43.79	43.34	43.59	45.25	47.89	48.94	4.10

PERMISSIBLES AND OTHER EXPLOSIVES

[Quantities in pounds]

Capacity	38,678,332	38,028,332	38,028,332	38,028,332	38,028,332	36,528,332	36,528,332	36,528,332	36,528,332	36,528,332	36,528,332	36,528,332	446,489,984
Manufactured	22,321,534	22,011,137	25,846,470	28,239,286	28,018,278	23,248,336	22,633,163	24,765,153	22,042,903	22,538,498	20,651,606	19,094,505	281,410,869
Percentage of capacity	57.71	57.88	67.97	74.26	73.68	63.64	61.96	67.80	60.34	61.70	56.54	52.27	63.03
Shipments	21,781,936	22,196,916	25,798,789	28,224,993	27,153,236	24,295,584	21,415,070	26,104,336	21,851,071	22,540,335	21,250,176	18,943,482	281,555,924
Percentage of capacity	56.32	58.37	67.84	74.22	71.40	66.51	58.63	71.46	59.82	61.71	58.17	51.86	63.06
Sales	21,235,837	20,443,818	23,318,222	28,599,481	26,005,655	22,227,435	20,446,484	23,771,260	20,695,675	21,909,306	20,331,109	17,833,497	266,817,779
Percentage of capacity	54.90	53.76	61.16	75.15	68.19	60.74	55.97	64.93	56.66	59.98	55.66	48.82	59.76
Stocks, end of month	7,047,798	6,834,830	7,138,023	6,840,191	7,704,558	6,512,958	7,844,746	6,723,023	6,892,405	6,775,963	6,196,260	6,336,173	6,336,173
Percentage of capacity	18.22	17.97	18.77	17.99	20.26	17.83	21.48	18.40	18.87	18.55	16.96	17.35	1.42

[1] Covers only those mills from which monthly reports are received.

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MINE FATALITIES DUE TO EXPLOSIVES

During the past 12 years mining accidents due to the use of explosives have caused 2.6 to 5.8 per cent of all fatalities at bituminous coal mines, 4.1 to 8.9 per cent at anthracite mines, 8.7 to 14.2 per cent at metal mines, and 13.6 to 27.3 per cent at quarries. No data are available regarding nonfatal accidents at coal mines, but the record shows that only 1.1 to 2 per cent of all injuries at metal mines and from 1.7 to 6.3 per cent of those at quarries have been due to the use of explosives. For every fatality due to explosives since 1911, there have been 7.6 nonfatal injuries at metal mines and 8.1 nonfatal injuries at quarries. Fatalities to underground employees at coal mines since 1911 are presented in Table 20; the figures (omitting 1919) show that 37 to 61 per cent of the fatalities occurred at the anthracite mines in Pennsylvania which have produced from 11 to 18 per cent of the coal tonnage of the United States. The anthracite mines normally consume from 52 to 68 per cent of all dynamite and other high explosives used at the coal mines in this country, 18 to 31 per cent of all permissible explosives, and 8 to 17 per cent of all black blasting powder. In 1919 the number of fatalities at anthracite mines was abnormally high (149, or 72 per cent), because of a powder explosion in Baltimore Tunnel No. 2 at Wilkes-Barre on June 5, which caused the death of 92 men.

Table 21 shows the causes of fatalities and injuries due to explosives in the mining industry in 1922.

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TABLE 19. *Fatalities and injuries due to explosives at mines and quarries, and rates per 1,000 men employed (300-day workers)*

	Bituminous coal mines			Anthracite and bituminous coal mines			Metal mines						Quarries					
	Killed	Per cent	Rate	Killed	Per cent	Rate	Killed	Per cent	Rate	Injured	Per cent	Rate	Killed	Per cent	Rate	Injured	Per cent	Rate
1901																		
1902																		
1903	138	9.80																
1904	121	8.64																
1905	119	7.49																
1906	115	7.27																
1907	134	5.29																
1908	109	6.17																
1909	122	5.88																
1910	113	5.09																
1911	72	3.68	0.184	160	6.02	0.299	78	11.22	0.500	531	2.00	3.40	50	26.60	0.592	341	6.33	4.04
1912	70	3.85	.171	147	6.08	.271	94	14.22	.581	573	1.86	3.54	47	22.06	.501	260	3.97	2.77
1913	63	2.91	.142	138	4.96	.232	89	13.03	.485	579	1.76	3.15	44	24.04	.505	332	4.29	3.81
1914	56	3.01	.147	146	5.95	.277	60	10.73	.421	464	1.54	3.25	35	19.44	.513	285	3.38	3.89
1915	76	4.52	.202	155	6.83	.303	78	14.10	.549	388	1.10	2.73	28	18.92	.339	227	2.35	2.75
1916	60	3.59	.139	146	6.56	.258	89	12.77	.462	870	1.80	4.52	28	16.18	.366	338	2.52	4.42
1917	55	2.60	.112	110	4.08	.173	79	9.27	.411	617	1.33	3.21	21	16.03	.294	271	2.05	3.79
1918	85	4.19	.166	135	5.23	.206	89	13.78	.492	657	1.53	3.63	17	13.60	.286	151	1.73	2.55
1919	57	3.39	.141	206	8.89	.380	48	10.26	.352	412	1.31	3.05	24	19.51	.376	167	1.81	2.62
1920	79	4.44	.168	128	5.64	.213	57	13.41	.424	496	1.52	3.69	36	20.23	.467	214	1.91	2.78
1921	84	5.83	.254	152	7.65	.320	23	10.00	.309	258	1.39	3.46	17	14.17	.283	198	1.89	3.30
1922	54	3.22	.166	92	4.65	.227	30	8.72	.309	370	1.42	3.81	36	27.27	.523	288	2.43	4.18
1923	65	3.35	(1)	114	4.65	(1)												

[1] Not available.

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TABLE 20. *Coal-mine fatalities underground due to explosives, 1911 to 1923*

States	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923
Pennsylvania (anthracite)	88	77	75	90	79	86	55	50	[1] 149	49	68	28	49
Pennsylvania (bituminous)	6	8	4	7	9	10	6	6	17	22	15	10	13
West Virginia	3	8	8	5	6	3	6	14	6	12	14	17	14
Illinois	15	11	11	9	11	6	9	12	2	9	11	3	9
Ohio	3	5	6	2	3	5	4	8	10	10	3	5	3
Indiana, Michigan, and Kentucky	15	3	5	12	12	10	14	20	11	9	26	9	13
Alabama, Tennessee, Georgia, and North Carolina	6	6	2	2	10	3	3	5	3	6	9	1	3
Iowa, Kansas, and Missouri	4	14	6	4	13	9	2	7	2	3	1	-----	2
Colorado, New Mexico, and Utah	3	1	7	4	-----	4	3	3	1	4	-----	2	5
Maryland and Virginia	-----	10	2	-----	4	3	2	5	2	-----	-----	1	1
Montana, North Dakota, and Wyoming	4	2	4	4	3	2	2	1	2	1		2	2
Arkansas, Oklahoma, and Texas	11	1	5	4	5	1	4	4	-----	3	3	3	-----
Alaska, California, Idaho, Nevada, Oregon, and Washington	2	1	3	3	-----	4	-----	-----	1	-----	2	1	-----
Total	160	147	138	146	155	146	110 [2]	135	206	123	159	93	114

[1] Of this number, 92 men were killed in the powder explosion in Baltimore Tunnel No. 2, Wilkes-Barre, Pa., on June 5, 1919.

TABLE 21. *Fatalities and injuries due to explosives in the mineral industry, 1922*

KILLED

Branch of mineral industry	Transportation	Charging	Suffocation	Drilling into old holes	Striking into loose rock or ore	Thawing	Caps, detonators, etc.	Unguarded shots	Returned too soon	Premature shots	Sparks from match, lamp, or candle	Delayed blast	Shot breaking through rib or pillar	Miscellaneous	Total
Quarries	1	14	----	2	----	----	1	----	----	13	----	1	----	4	36
Coal mines (underground)	----	5	5	1	1	----	3	3	11	31	7	7	6	11	91
Metal mins (underground)[1]	1	----	2	3	1	----	1	----	2	2	----	----	----	1	13
Metal mines (open pit)[1]	----	----	----	----	----	----	----	----	----	----	----	----	----	----	0
Total	2	19	7	6	2	----	5	3	13	46	7	8	6	16	140

INJURED

Quarries	7	22	----	12	15	----	7	3	8	20	----	7	----	187	288
Coal mines (underground)[2]	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Metal mines (underground)[1]	10	1	21	13	2	1	18	18	10	9	----	----	----	85	188
Metal mines (open pit)[1]	----	1	----	----	----	----	----	----	----	3	----	----	----	3	7
Total (excluding coal mines)	17	24	21	25	17	1	25	21	18	32	----	7	----	275	483

[1] From selected returns only. Details as to subdivisions not available for all metal mines.
[2] Not available.

SODATOL AND PICRIC ACID

When the armistice was signed on November 11, 1918, the United States Government had in its possession large quantities of T. N. T. and other war explosives. Use for these surplus war explosives in peace-time industries received consideration by the War Department and other agencies. Authority of Congress was obtained whereby such quantities of the explosives as were no longer needed

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by the War Department for military purposes might be distributed to other branches of the Federal Government having supervision of work requiring the use of explosives. Thus large quantities of the surplus war explosives found their way into industrial use.

The principal agencies of the Government through which the explosives were distributed were the Department of the Interior and the Department of Agriculture. Explosives distributed by the Interior Department through the Bureau of Mines were used by the Bureau of Indian Affairs, the Bureau of Reclamation, the Alaskan Engineering Commission, and the National Parks Bureau. Explosives distributed through the Department of Agriculture were used mainly if not entirely by the Bureau of Public Roads.

The Bureau of Mines attempted several years ago to obtain information regarding the quantities of explosives received from the War Department and used for farm clearing, road work, etc., in each State. It was intended to incorporate the data in the bureau's regular yearly report showing the consumption of industrial explosives in the United States. Unfortunately it did not prove practicable to obtain from the various agencies using the explosives the actual figures in such form as to permit them to be presented definitely in tabular statements covering a specific period of time. For 1923, however, the bureau received, through the courtesy of the Bureau of Public Roads, a statement showing the quantities of sodatol and picric acid used in the various States for farm purposes and for road construction. The data are therefore presented in Table 22. During the year 6,737,000 pounds of sodatol were distributed, of which 1,304,450 pounds were used for road construction and 5,432,550 pounds for farming purposes. The quantity of picric acid distributed was 3,587,250 pounds, of which 1,311,650 pounds were for road construction and 2,275,600 pounds for farm work. The principal States in which the sodatol was used were Wisconsin, Michigan, Minnesota, Washington, North Carolina, and Oregon. These States used about three-fourths of the total quantity distributed. States receiving the largest quantities of picric acid were Wisconsin, Minnesota, Michigan, South Dakota, and Mississippi; these States received about 70 per cent of the total quantity distributed during 1923.

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TABLE 22. *Number of pounds of* **sodatol** *and* **picric acid** *distributed by Bureau of Public Roads, U. S. Department of Agriculture, during the calendar year 1923*

State	Sodatol			Picric acid		
	Used for road construction	Used for farm purposes	Total	Used for road construction	Used for farm purposes	Total
	Pounds	*Pounds*	*Pounds*	*Pounds*	*Pounds*	*Pounds*
Alabama	10,000	56,000	66,000			
Alaska					5,500	5,500
Arizona	40,000		40,000	6,000		6,000
California	180,000	50,000	230,000			
Colorado	160,800		160,800	62,400		62,400
Georgia		20,000	20,000			
Idaho		118,250	118,250			
Illinois	500		500			
Iowa	40,000		40,000		102,600	102,600
Kansas	27,300		27,300	38,250		38,250
Kentucky		38,150	38,150			
Louisiana		16,000	16,000			
Maryland	500		500			
Michigan		578,600	578,600		201,900	201,900
Minnesota	146,900	707,000	853,900	125,000	470,100	595,100
Mississippi	96,000	20,000	116,000	120,000	18,000	138,000
Missouri	200	53,000	53,200			
Montana	20,000		20,000			
Nebraska		20,900	20,900		67,000	67,000
New Hampshire	2,000		2,000			
New Mexico				40,000		40,000
New York				20,000		20,000
North Carolina	45,000	345,500	390,500		18,000	18,000
Ohio	30,250	17,000	47,250			
Oregon		374,300	374,300			
Pennsylvania		18,000	18,000			
South Carolina		100,600	100,600			
South Dakota	96,000	25,000	121,000	150,000		150,000
Tennessee		19,900	19,900			
Texas	84,000	40,050	124,050			
Vermont	25,000		25,000			
Virginia	45,000		45,000			
Washington	75,000	770,700	845,700			
Wisconsin		2,043,600	2,043,600		1,392,500	1,392,500
Government agencies	180,000		180,000	750,000		750,000
Total	1,304,450	5,432,550	6,737,000	1,311,650	2,275,600	3,587,250

EXPLOSIVES USED IN FOREIGN COUNTRIES

Tables 23 and 24 are presented to show the amount of explosives used in mining operations in Great Britain and British Columbia for 1911 and later years. In Great Britain, where coal-mining operations are generally conducted on the longwall system, explosives are not required in such large quantities as in the United States. During the five years ended 1915 the consumption of explosives in Great Britain at mines under the coal mines act was 79 pounds per thousand net tons of coal; in the five years ended 1920 the consumption had increased to 95 pounds per thousand tons. The figures for British Columbia do not relate to years prior to 1915, but in that year an average of 149 pounds of explosives was used per thousand net tons of coal mined in the Province; in 1922 the average was 224 pounds. During the last two years covered by the table all shot firing at coal mines in British Columbia has been by electricity.

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TABLE 23. *Explosives used at mines and quarries in Great Britain*

Year	Production[1]	Explosives used at				Total quantity used at mines, quarries, and open workings
		Mines under the coal mines act		Mines under the metalliferous mines regulation act	Quarries under the quarries act and at other mineral workings	
	Net tons	*Pounds*		*Pounds*	*Pounds*	*Pounds*
1911	320,255,300	24,341,006		1,851,444	5,105,438	31,297,888
1912	305,975,041	23,423,138		1,885,158	4,825,961	30,134,257
1913	337,804,715	26,335,195		1,932,443	5,394,302	33,661,940
1914	312,575,730	25,521,098		1,773,800	5,098,286	32,393,184
1915	296,236,935	24,287,633		1,491,423	4,436,099	30,215,155
1916	299,110,504	25,359,676		1,606,555	3,834,996	30,801,227
1917	291,334,466	26,382,252		1,557,331	3,798,068	31,737,651
1918	267,587,603	24,595,790		1,633,052	3,640,835	29,869,677
1919	268,353,052	27,139,391		1,491,860	3,664,495	32,295,746
		Permitted	Other			
		Pounds	*Pounds*			
1920	268,393,080	13,562,018	15,596,562	1,584,326	4,403,032	35,145,938
1921	188,207,655	9,816,607	9,851,604	719,285	3,201,878	23,589,374
1922	286,688,300	14,254,664	13,891,281	1,039,602	4,030,780	33,216,327

[1] Includes all minerals under the coal mines act.

TABLE 24. *Explosives used in coal mines in British Columbia*

Year	Production of coal		Explosives				
	Long tons	Short tons	Pounds	Number of shots fired, total	Shots fired by electricity	Shots fired by fuze	Pounds of explosives per shot
1915	1,972,577	2,209,286	330,193	489,437	342,046	147,391	0.67
1916	2,487,820	2,786,358	503,009	667,837	550,333	117,504	0.75
1917	2,398,715	2,686,561	552,157	826,107	649,128	176,979	0.66
1918	2,578,725	2,888,172	536,196	645,404	638,866	6,538	0.83
1919	2,408,948	2,698,022	533,707	656,585	654,463	470	0.81
1920	2,696,774	3,020,387	583,994	753,496	752,405	1,091	0.77
1921	2,754,526	3,085,069	582,904	775,773	775,773	.....	0.75
1922	2,590,915	2,890,625	646,543	852,398	852,398	.....	0.76

Companies manufacturing explosives in 1923

(B, Black powder; H, High explosives other than permissible; P, Permissibles)

B., H., P..... Atlas Powder Co., Wilmington, Del.
B..... Austin Powder Co., Cleveland, Ohio.
B..... Anthracite Powder Co., Mahanoy City, Pa.
H., P..... Apache Powder Co., Benson, Ariz.
B..... Black Diamond Powder Co., Pittston, Pa.
B., H., P..... E. I. du Pont de Nemours & Co., Wilmington, Del.
B..... Equitable Powder Manufacturing Co., East Alton, Ill.
B..... Egyptian Powder Co., East Alton, Ill.
B..... Excelsior Powder Manufacturing Co., Kansas City, Mo.
H., P..... General Explosives Co., Chicago, Ill.
B., H., P..... Grasselli Powder Co., Cleveland, Ohio.
H., P..... Giant Powder Co., Cons., San Francisco, Calif.

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B., H., P..... Hercules Powder Co., Wilmington, Del.
H., P..... Illinois Powder Manufacturing Co., St. Louis, Mo.
B..... King Powder Co., Cincinnati, Ohio.
H..... Nitro Powder Co., Kingston, N. Y.
H., P..... Puget Sound & Alaska Powder Co., Everett, Wash.
B., H., P..... Peerless Explosives Co., Wilkes-Barre, Pa.
H..... Rockburst Powder Co., Cleveland, Ohio.
B..... Senior Powder Co., Cincinnati, Ohio.
H., P..... Trojan Powder Co., Allentown, Pa.
B..... United States Powder Co., Terre Haute, Ind.
H., P..... Union Explosives Co., Clarksburg, W. Va.
B..... Western Powder Manufacturing Co., Peoria, Ill.

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